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FLOOD INSURANCE STUDY

ORIGINAL

CITY OF PITTSBURG, CALIFORNIA
CONTRA COSTA COUNTY

REVISED
JULY 2, 1987

Federal Emergency Management Agency

COMMUNITY NUMBER - 060033

32

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NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
	1.1 Purpose of Study	1
	1.2 Authority and Acknowledgments	1
	1.3 Coordination	2
2.0	AREA STUDIED	3
	2.1 Scope of Study	3
	2.2 Community Description	3
	2.3 Principal Flood Problems	5
	2.4 Flood Protection Measures	6
3.0	ENGINEERING METHODS	7
	3.1 Hydrologic Analyses	7
	3.2 Hydraulic Analyses	10
4.0	FLOODPLAIN MANAGEMENT APPLICATIONS	12
	4.1 Floodplain Boundaries	12
	4.2 Floodways	13
5.0	INSURANCE APPLICATION	13
6.0	FLOOD INSURANCE RATE MAP	16
7.0	OTHER STUDIES	16
8.0	LOCATION OF DATA	17
9.0	BIBLIOGRAPHY AND REFERENCES	17

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TABLE OF CONTENTS (cont.)

Page

FIGURES

Figure 1 - Vicinity Map 4
Figure 2 - Floodway Schematic 15

TABLES

Table 1 - Summary of Discharges 8
Table 2 - Summary of Elevations 10
Table 3 - Floodway Data 14

EXHIBITS

Exhibit 1 - Flood Profiles

Kirker Creek	Panels 01P-05P
Lawlor Creek	Panels 06P-07P
Los Medanos Wasteway	Panel 08P

Exhibit 2 - Flood Insurance Rate Map Index
Flood Insurance Rate Map

Exhibit 3 - Elevation Reference Marks

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FLOOD INSURANCE STUDY
CITY OF PITTSBURG, CONTRA COSTA COUNTY, CALIFORNIA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Pittsburg, Contra Costa County, California and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

This Flood Insurance Study revises and updates a previous Flood Insurance Study/Flood Insurance Rate Map for the City of Pittsburg. This information will be used by the City of Pittsburg to update existing floodplain regulations as part of the Regular Phase of the NFIP. The information will also be used by local and regional planners to further promote sound land use and floodplain development.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for the study completed in November 1978, were performed by Tudor Engineering Company, for the Federal Emergency Management Agency (FEMA), under Contract No. H-4033. A study of tidal flooding on the Sacramento-San Joaquin Delta area was performed by the U.S. Army Corps of Engineers (COE) under InterAgency Agreement No. IAA-EMW-E-1153, Project Order No. 1, Amendments No. 22 and 22(a). This study was completed in November 1985.

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1.3 Coordination

The Consultation Coordination Officer, appointed by FEMA, organized the initial community meeting, held on May 13, 1976. At this meeting, attended by representatives of the City of Pittsburg, FEMA, and the study contractor (Tudor Engineering Company), the streams requiring detailed and approximate study were identified.

Agencies contacted for the coordination of this Flood Insurance Study were the City of Pittsburg and the Contra Costa County Flood Control and Water Conservation District.

The intermediate community meeting was held on September 6, 1978, at which time preliminary results were presented. This meeting was attended by representatives from the City of Pittsburg, the Contra Costa County Flood Control District, the Federal Emergency Management Agency, and the study contractor.

The results of the first study were reviewed at a final community coordination meeting held on April 23, 1979. Attending the meeting were representatives of the Federal Emergency Management Agency, the study contractor, the Contra Costa County Flood Control District and the city. This study incorporates all appropriate comments, and all problems have been resolved.

An initial coordination meeting for the restudy of tidal flooding in the Delta area was held on July 25, 1983, which was attended by representatives of Contra Costa County, Sacramento County, San Joaquin County, Solano County, Yolo County, the State of California, FEMA, and the study contractor (COE). Flood insurance, in general, and the Flood Insurance Study for the Delta area, in particular, were discussed. Information on study procedures and the types of data required to make the study were presented, and the streams and areas to be studied by detailed methods were identified.

In November 1983, a notice of study initiation for the Delta Flood Insurance Study, which contained a request for pertinent data, was sent to various Federal, State, and local agencies and individuals. An announcement of the intent to perform a flood elevation study in the Delta area was published in the local newspapers. Direct contacts for information were made with representatives of the California Department of Water Resources, the Contra Costa Planning Department, the Sacramento County Water Resources Division, the San Joaquin County Flood Control District, and the San Joaquin Planning Department, the City of Lodi's Public Works Department, numerous Reclamation Districts and architectural-engineering firms.

An intermediate/final coordination meeting was held on November 7, 1985. In attendance were representatives of FEMA, the State of California, the study contractor, and Sacramento and Contra Costa Counties.

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2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the City of Pittsburg, Contra Costa County, California. The area of study is shown on the Vicinity Map (Figure 1).

Floods caused by the overflow of Kirker Creek were studied in detail within the Pittsburg corporate limits. Also studied in detail were Lawlor Creek through Lawlor Ravine and Los Medanos Wasteway. Floods that caused high tides in Suisun Bay (New York Slough) were also studied by detailed methods. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through November 1990.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the City of Pittsburg.

2.2 Community Description

Pittsburg is located in north-central Contra Costa County in west-central California, approximately 40 miles northeast of San Francisco. Adjacent to Pittsburg, on the east, is the City of Antioch. Pittsburg is situated on the south shore of Suisun Bay (New York Slough) at the confluence of the Sacramento and San Joaquin Rivers.

Broad, gently sloping alluvial fans underlie most of the city. Steep, grass-covered hills rise abruptly at the southern corporate limits and crest at elevations of 1200 to 1800 feet along the drainage divide 4 miles further south.

Most of the City of Pittsburg is drained by Kirker Creek, which originates in the hills and flows north through the city. The extreme western section of the city is drained by Lawlor Creek through Lawlor Ravine. A number of parallel drainages intervene. Development within floodplain areas consists mostly of light industrial and residential areas.

The climate of Pittsburg is typical of the central coast region of California, with warm, dry summers and cool, wet winters. The average annual precipitation is approximately 11 inches, with most of the rainfall occurring between October and April. The average annual temperature is 58°F, with average daytime temperatures ranging from 43°F in January to 72°F in September (Reference 1).

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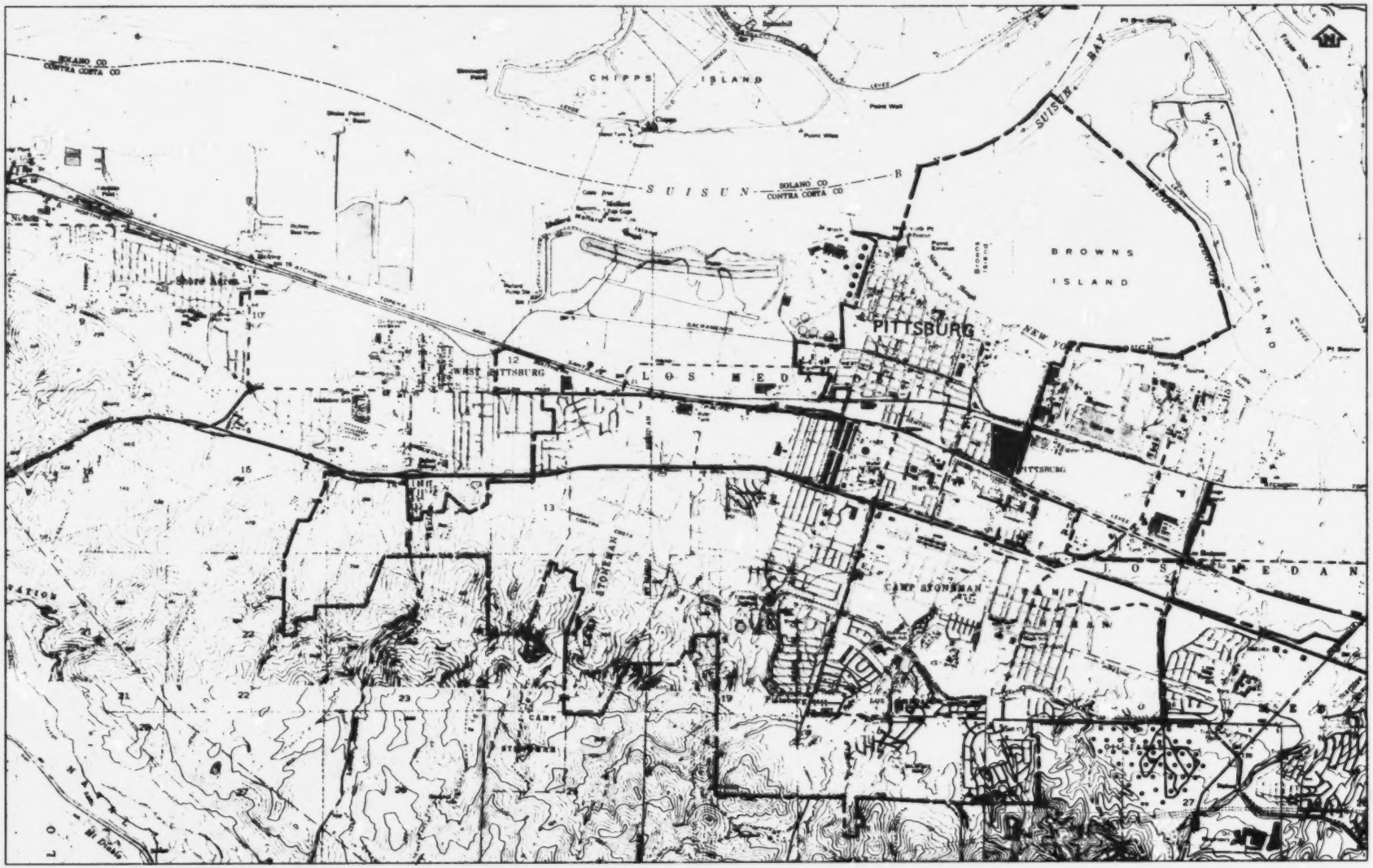

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PITTSBURG, CA
(CONTRA COSTA CO.)

APPROXIMATE SCALE

3140 0 3140 6280 9420 FEET

VICINITY MAP

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The city was founded in 1849, when Colonel J. D. Stevenson purchased most of the Rancho Los Mendanos and named it New York of the Pacific after his own home town. The name was soon changed to New York Landing. In 1855, coal was discovered in the nearby hills and the city experienced a surge of growth, largely due to an influx of the Welsh miners. The city was renamed Black Diamond in honor of the most successful mine. In 1901, the first electric power company was opened in Pittsburg, which opened the door for industrial development. Discovery of cheaper coal in the Pacific Northwest forced the mines to suddenly close, but the availability of power, augmented by rail and water transportation, ensured the growth of the city as surrounding towns floundered. Black Diamond was incorporated in 1903. The name was changed to Pittsburg in 1911 because of the development of the steel industry (Reference 2). The population of Pittsburg continued to grow rapidly from the turn of the century to the present, except during the 1930s. In 1985, the population was 38,845, which represents an increase of 18% over the 1980 figure of 33,034 (Reference 3).

2.3 Principal Flood Problems

Due to the low-lying tidal nature and low elevations of the Delta area (25 feet below sea level in the central part to 20 feet above sea level on the periphery), the entire region must be considered to be in a floodplain. Flood conditions in the Delta are influenced by Pacific Ocean tides, high flood outflow from tributary streams, and strong onshore winds. A single island or a group of islands may flood when the levees protecting them are overtopped or fail as a result of the separate or coincidental occurrence of higher high tides and high stream outflow through the Delta.

The Delta area is at the juncture of the two major drainage systems in Northern California - the Sacramento and San Joaquin Rivers. General rainfloods emanating from these two basins can occur anytime during the period from November through April. This type of flood results from prolonged heavy rainfall over tributary areas and is characterized by high peak flows of moderate duration and by a large volume of runoff. Flooding is more severe when antecedent rainfall has resulted in saturated ground conditions, when the ground in tributary areas is frozen and infiltration is minimal, or when rain on snow in the high elevations adds snowmelt to rainflood runoff.

Snowmelt floods on the Sacramento and San Joaquin Rivers and their higher elevation tributaries can be expected to occur during the period from April through June. Although snowmelt flooding is of much larger volume and longer duration than flooding from rain, it does not have the high peak flows characteristic of floods from rain. Snowmelt flood runoff is sometimes augmented by late spring rains on the snowfields or lower elevation tributary watersheds.

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Cloudburst storms lasting as long as 3 hours can occur over either the Delta area or the tributary drainage areas anytime from late spring to early fall, and may occur within a general rainstorm. Cloudbursts are high-intensity storms that can produce floods characterized by high peak flows, short duration of floodflow, and small volume of runoff. However, cloudburst storms are usually small in areal extent and could not affect flood flows or flood stage in the Delta area.

The lower reaches of the Sacramento and San Joaquin Rivers and the entire Delta area are under the influence of the tides. The most severe flood conditions in the Delta would result when very high tides and large volume of stream outflow occur coincidentally, and strong onshore winds generate wave action. It should be noted that precipitation over the Delta does not materially affect local flood conditions.

Only minor reports of past flooding in Pittsburg were found, however there has been no major flooding in this region of Contra Costa County in the recent past. The February 1986 flood caused some erosion and damage to homes along Kirker Creek. The storms of 1955 and 1963 produced minor flooding in the adjacent city of Antioch and flood peaks equal to an approximate 15-year recurrence in the Marsh Creek basin, located 10 miles south of Pittsburg. All riverine flooding is caused by rainfall, with minor flooding in tidal areas.

2.4 Flood Protection Measures

Pittsburg is afforded flood protection, either directly or indirectly, by essentially every flood control storage project influencing inflow to the Delta area. This includes 17 major dams and reservoirs on the main stem and tributary streams from the upper Sacramento River in Shasta County on the north to the upper San Joaquin River in Fresno County on the south. Other storage projects in the Central Valley are authorized but not started or in preauthorization study stage. NOTE: Projects in the Tulare Lake Basin are excluded from this discussion because the possibility of floodwater overflowing from that basin is extremely remote. The last such overflow occurred in 1878.

Each major storage project in the Central Valley comprises a unit of a comprehensive, integrated system that includes levees, improved channels, floodway bypasses, and other improvements for flood control as well as storage projects. Additional project works to augment the protection that is presently provided are being considered by the U.S. Army Corps of Engineers in ongoing investigations of flood control and related water resources development problems in the Central Valley.

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All of the waterways under study in the Delta area are leveed. These levees are classified as either direct agreement, project, or nonproject. Direct agreement levees were either constructed as part of a navigation project or rebuilt by the Federal Government after a flood and are maintained by local reclamation districts to Federal standards. These levees constitute only about 10 percent of the total levee system. Project levees were either constructed by local interests and then rebuilt to Federal standards or adopted as part of a Federal flood control project. About 15 percent of the Delta levee system falls into this category and is maintained to Federal standards by local interests. Nonproject levees were privately constructed, are maintained by private owners or local agencies, and often receive minimal maintenance that is rarely performed to any kind of uniform standards. About 75 percent of the Delta levees are in this category.

The City of Pittsburg has a floodplain development ordinance that restricts development in the special flood hazard zones. In 1968 the city initiated plans for channel improvements along Kirker Creek. Sections of the improvement have been implemented (Reference 4). There are no other flood protection measures being taken in Pittsburg.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1 and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships and peak elevation-frequency relationships for each flooding source studied in detail affecting the community.

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For streams in Pittsburg (excluding the San Joaquin River along Suisun Bay), frequency analyses were based primarily on a regional regression analysis developed by the study contractor for the Central-Delta region of Contra Costa County. The records from 16 U.S. Geological Survey stream gaging stations containing 278 measured annual flow peaks (Reference 5) were utilized to establish the peak discharge-frequency relationships at the stations in accordance with U.S. Water Resources Council procedures (Reference 6). There is no stream gaging station on either Kirker Creek, Lawlor Creek, or Los Medanos Wasteway. The relationships developed at the gaging stations were transferred to ungaged basins in Pittsburg by means of the statistical technique of stepwise multiple regression. The significant basin characteristics were drainage area and mean annual precipitation.

Certain special situations required additional analyses. Floodflows from those basins which have undergone significant urbanization were adjusted upward in accordance with the percentage of the drainage area which was urbanized and which was served by improved major drainage channels. On Kirker Creek, overflow behind the Pittsburg-Antioch Highway bypasses much of the floodflows to the east and rejoins Kirker Creek west of Loveridge Avenue, where it again overflows toward New York Slough before it reaches the entrance to the Pittsburg Sewage Treatment Plant at Standard Oil Avenue.

Peak discharge-drainage area relationships for Kirker Creek, Lawlor Creek, and Los Medanos Wasteway are shown in Table 1.

TABLE 1. SUMMARY OF DISCHARGES

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second) 10-Year	50-Year	100-Year	500-Year
Kirker Creek					
At Standard Oil Avenue	12.7	470[1]	1,350[1]	1,500[1]	1,500[1]
Downstream of State Highway 4	10.9	470[1]	500[1]	520[1]	540[1]
Upstream of State Highway 4	10.9	780	1,660	2,100	3,700
At Los Medanos Wasteway	8.2	630	1,300	1,670	2,900
At Buchanan Road	7.1	580	1,200	1,500	2,500
Lawlor Creek					
At Pittsburg	1.1	170	260	310	460
Los Medanos Wasteway					
Above Dow Channel	----[2]	70	110	290	570

[1] Flood Peaks Reduced Due to Bypassing or Non-Returning Overflow.
[2] Drainage Area Not Available.

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For studies of tidal flooding along San Joaquin River at Suisun Bay (New York Slough), tidal action, tributary basin runoff, and meteorologic conditions are the major factors influencing water-surface elevations associated with the San Joaquin River.

Frequency analyses of water-surface elevations in the San Joaquin River were performed using an analytical study of higher high stage-frequency relationships for 24 gaging stations located throughout the Delta area (Reference 2). The selected period of record for the analyses (1945 to 1974) is subsequent to construction of Shasta Dam on the Sacramento River and covers the maximum length of record for the majority of the gages. Also, the Delta hydraulic pattern has not changed significantly during that period. For continuity among the gages used in this study, all gage data were adjusted to a datum of zero elevation, National Geodetic Vertical Datum (NGVD) of 1929.

Originally, the stage data were statistically analyzed using the Pearson Type III distribution method included in U.S. Water Resources Council guidelines (Reference 3). The resultant curves did not reflect either levee overtopping or levee breaks resulting in extensive areal inundation. Therefore, the shape of the curves was graphically developed to include those conditions. The stage-frequency relationship for each gage was compared with the stage-frequency relationships developed for adjacent gages and, if necessary, adjusted to obtain consistency.

The Sacramento-San Joaquin Delta to the Golden Gate is represented on two grid systems. The coarse grid contains some 250 nodes connected by 325 channels; the fine grid contains 1,200 nodes and 1,800 channels. In addition to physical parameters of the individual channels, the model uses inflow, outflow, evaporation losses, tidal elevations, and wind velocity to solve for water-surface elevations.

Higher-high stage-frequency profiles were developed for defined channel reaches by connecting a line between the higher-high stage data for each pertinent gage. It should be noted that a stage shown on the stage-frequency curve for one gage is valid only for that particular gage being analyzed. Synthetic higher-high stage profiles for the 50- and 100-year and larger events were developed for six main channel reaches within the Delta. The 50- and 100-year higher-high stage profiles were based on historical flood profiles and the higher-high stage-frequency curves. The extreme flow and extreme tide combinations were developed using the hydrodynamics model for the Delta area and historical flood profiles. The 10-year event was extrapolated from a curve developed from 50- and 100-year data.

The analyses used in this study reflect a static water condition, which includes a combination of river inflow, tidal effect, and wind set.

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Elevations for floods of the selected recurrence intervals on the New York Slough at Suisun Bay are shown in Table 2.

TABLE 2. SUMMARY OF ELEVATIONS

Flooding Source and Location	Elevation (feet) 10-Year	50-Year	100-Year	500-Year
Suisun Bay (New York Slough) At Pittsburg	6.0	6.3	6.5	6.7

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Flood elevations for riverine studies were computed using the U.S. Army Corps of Engineers HEC-2 step-backwater computer program (Reference 10). Culverts were analyzed using a culvert program based on U.S. Bureau of Public Roads methods (Reference 11).

Flooding in the New York Slough, located near the lower reaches of the Delta formed by the Sacramento and San Joaquin Rivers is under the influence of tides. Elevations for tidal floods of the selected recurrence intervals were obtained by extrapolating the existing U.S. Coast and Geodetic Survey data and correlating the data from various gages (References 7 and 8). Starting water-surface elevations in Suisun Bay (New York Slough) concurrent with floods of the selected recurrence intervals were set at mean higher high water. The effects of tsunami-induced flooding were considered and found to be insignificant compared to tidal flooding in that part of the bay.

Cross sections for backwater analyses were located at short distances upstream and downstream of bridges and other hydraulically significant features in order to establish the backwater effect of such features. Cross section data and work maps were obtained by photogrammetry and supplemented by field survey of bridges and culverts.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Insurance Rate Map (Exhibit 2).

For both Kirker and Lawlor Creeks, roughness factors (Manning's "n") used in the hydraulic computations were assigned on the basis of field inspection of floodplain areas. The values used for the channels ranged from 0.014 to 0.045; values for the overbanks ranged from 0.030 to 0.050. The channel value used for Los Medanos

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Wasteway was 0.025, while the overbank value was 0.028. These values were also derived from field observation. Starting water-surface elevations for Kirker Creek were taken from Los Medanos Wasteway at the outlet from Kirker Creek. Lawlor Creek water-surface elevations were started at normal depth downstream of the Southern Pacific Railroad. Los Medanos Wasteway starting water-surface elevations were developed using normal depth calculations.

Flood profiles were drawn showing computated water-surface elevations to an accuracy of ±0.5 foot for floods of the selected recurrence intervals (Exhibit 1).

Kirker Creek flows through a section of Pittsburg that was formerly the U.S. Army Camp Stoneman. Many undersized culverts under abandoned roads in this reach would force floodwaters to pond and overflow the banks of the channel to the east.

This water flows overland through the former campsite into another concrete channel carrying the overflow back to the main channel at State Highway 4. The backwater effects from each culvert aggravate the flooding at the next upstream crossing. This area is planned for residential and light industrial development. Some small industries and housing development have been built in flood prone areas and additional areas are under construction.

An undersized culvert under State Highway 4 subjects the other area in Pittsburg to serious flooding. The flooding here is aggravated by the traffic deflection barrier on the highway. This barrier acts as a dam and prevents any water from flowing over the highway back into Kirker Creek. The water is backed up behind the highway and overflows behind the Southern Pacific Railroad track, along the highway and down the highway, until it fills the underpass at Loveridge Road. The water then overflows the east side of the underpass and joins a small creek flowing north to join Kirker Creek.

For the Willow Creek feeder tributary, approximate 100-year elevations were determined using normal depth calculations.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum (NGVD) of 1929. Elevation reference marks used in this study are shown on the maps; the description of the marks are presented in Elevation Reference Marks (Exhibit 3).

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4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages state and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:3,600, with a contour interval of 2 feet (Reference 12). Flood boundaries along New York Slough have been delineated using aerial photomaps at a scale of 1:2,400 with a contour interval of 2 feet (Reference 13).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, and AO); and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the Willow Creek feeder tributary, approximate 100-year flood boundaries were delineated using the Honker Bay Quadrangle at a scale of 1:24,000 and a contour interval of 10 feet (Reference 14).

For the streams studied by approximate methods, only the 100-year floodplain boundary is shown on the Flood Insurance Rate Map (Exhibit 2.)

Approximate 100-year floodplain boundaries in some portions of the study area were taken directly from the Flood Hazard Boundary Map (Reference 15).

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4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

Because of the overflow nature of the flooding from Kirker Creek, both improvements to and encroachments on the creek would tend to increase the flood peak downstream and increase the overflow flooding elsewhere. The entire creek will have to be improved as one project in order to reduce flooding problems; therefore, no floodway was computed. The 100-year flooding along Lawlor Creek is contained within the channel; therefore, no floodway was computed. A floodway was computed for Los Medanos Wasteway.

The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated at selected cross sections (Table 3). In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Los Medanos Wasteway								
A	5,881	8	31	9.6	25.4	25.4	25.4	0.0
B	6,301	23	67	4.3	50.5	50.5	50.5	0.0
C	6,995	37	73	4.0	51.8	51.8	51.8	0.0

[1]Stream Distance in Feet Above Confluence with New York Slough

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PITTSBURG, CA
(CONTRA COSTA CO.)

FLOODWAY DATA

LOS MEDANOS WASTEWAY

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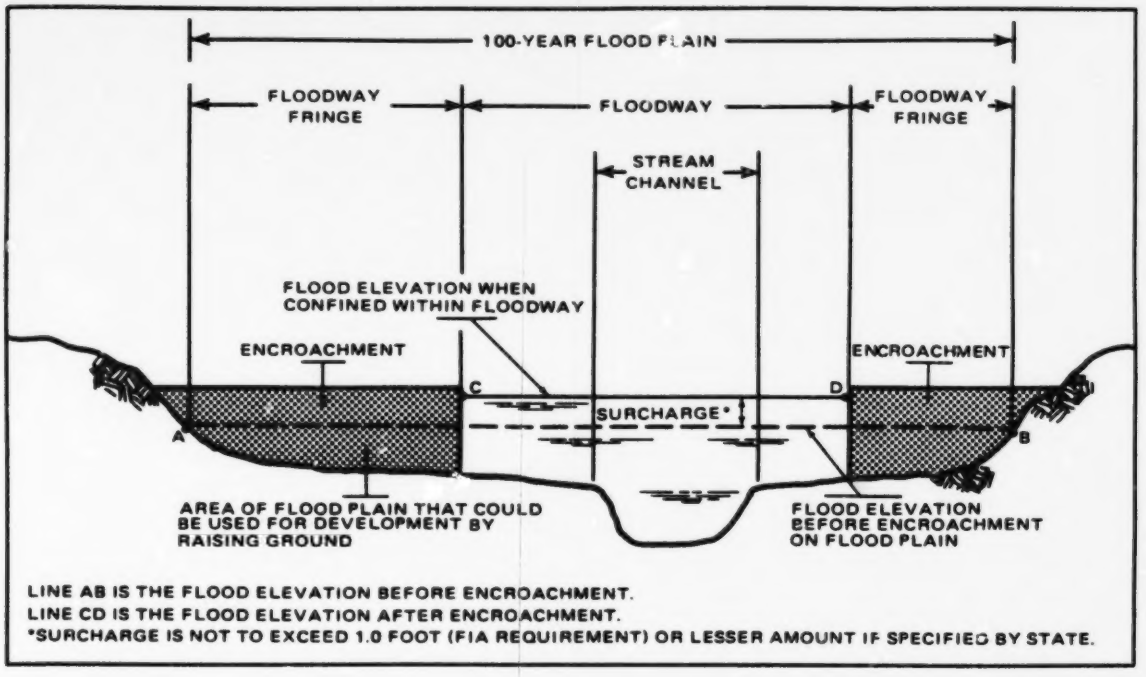
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

Figure 2. Floodway Schematic

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

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Zone A0

Zone A0 is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100- and 500-year floodplains, floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

A revised Flood Hazard Boundary Map for the City of Pittsburg, California has been published (Reference 15). The map contains approximate flood boundaries along Kirker and Willow Creeks for the community. This Flood Insurance Study is more detailed, and thus supersedes that map.

A Flood Insurance Study has been performed for the adjacent City of Antioch (Reference 16) and the unincorporated areas of Solano County (Reference 17). Also, a Flood Insurance Study is being conducted for the adjacent unincorporated areas of Contra Costa County from which information for Los Medanos Wasteway was taken (Reference 18). All information presented in the Contra Costa County Flood Insurance Study is in agreement with the City of Pittsburg Flood Insurance Study.

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This study is authoritative for the purpose of the National Flood Insurance Program; data presented herein either supersede or are compatible with all previous determinations.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Presidio of San Francisco, Building 105, San Francisco, California 94129.

9.0 BIBLIOGRAPHY AND REFERENCES

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EXHIBIT 3 - ELEVATION REFERENCE MARKS
CITY OF PITTSBURG, CONTRA COSTA COUNTY, CALIFORNIA

Reference Mark	Elevation (feet NGVD)	Description of Location
RM 1	114.89	A chiseled cross in the top of curb at a catch basin on the west side of Harbor Street; 35 feet south of Ventura Drive, at the easterly extension of the north building line located at 3810 Harbor Street. Established by Tudor Engineering Company.
RM 2	75.31	A chiseled square in the south curb of Garcia Avenue; 2 feet east of the northerly extension of the east building line of the Electro Manufacturing Company building at 750 Garcia Avenue. Established by Tudor Engineering Company.
RM 7	187.02	Contra Costa County standard disk set in concrete monument at northeast corner of intersection of Buchanan Road and Railroad Avenue, 2 feet behind curb on Buchanan Road, 4 feet east of Standard Pacific pole, 5 feet west of curb return. Established by Contra Costa County.
RM 14	192.20	Small PK nail set in concrete base of light pole at north side of entrance of United Presbyterian Church on Kirker Pass Road, 500 feet south of intersection of Kirker Pass and Buchanan Roads. Established by Contra Costa County.
RM 15	226.36	Brass disk on concrete monument, 0.5 mile south of intersection of Bailey Road and State Highway 4, 22 feet east of centerline of Bailey Road, 16 feet south of centerline of gravel driveway leading east to a farmhouse (Highland Boulevard). Established by Contra Costa County.

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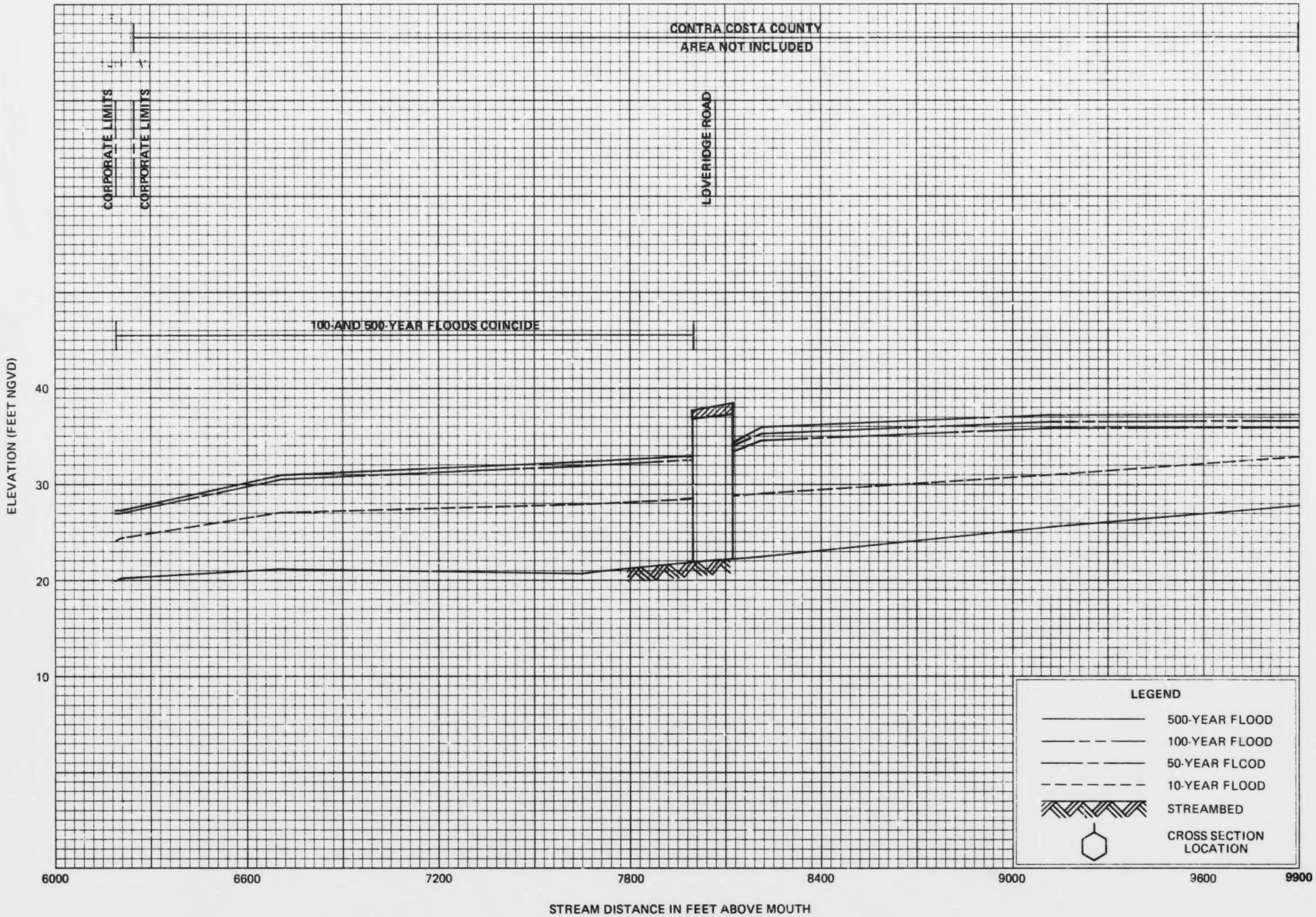

FLOOD PROFILES

KIRKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PITTSBURG, CA
(CONTRA COSTA CO.)

01P

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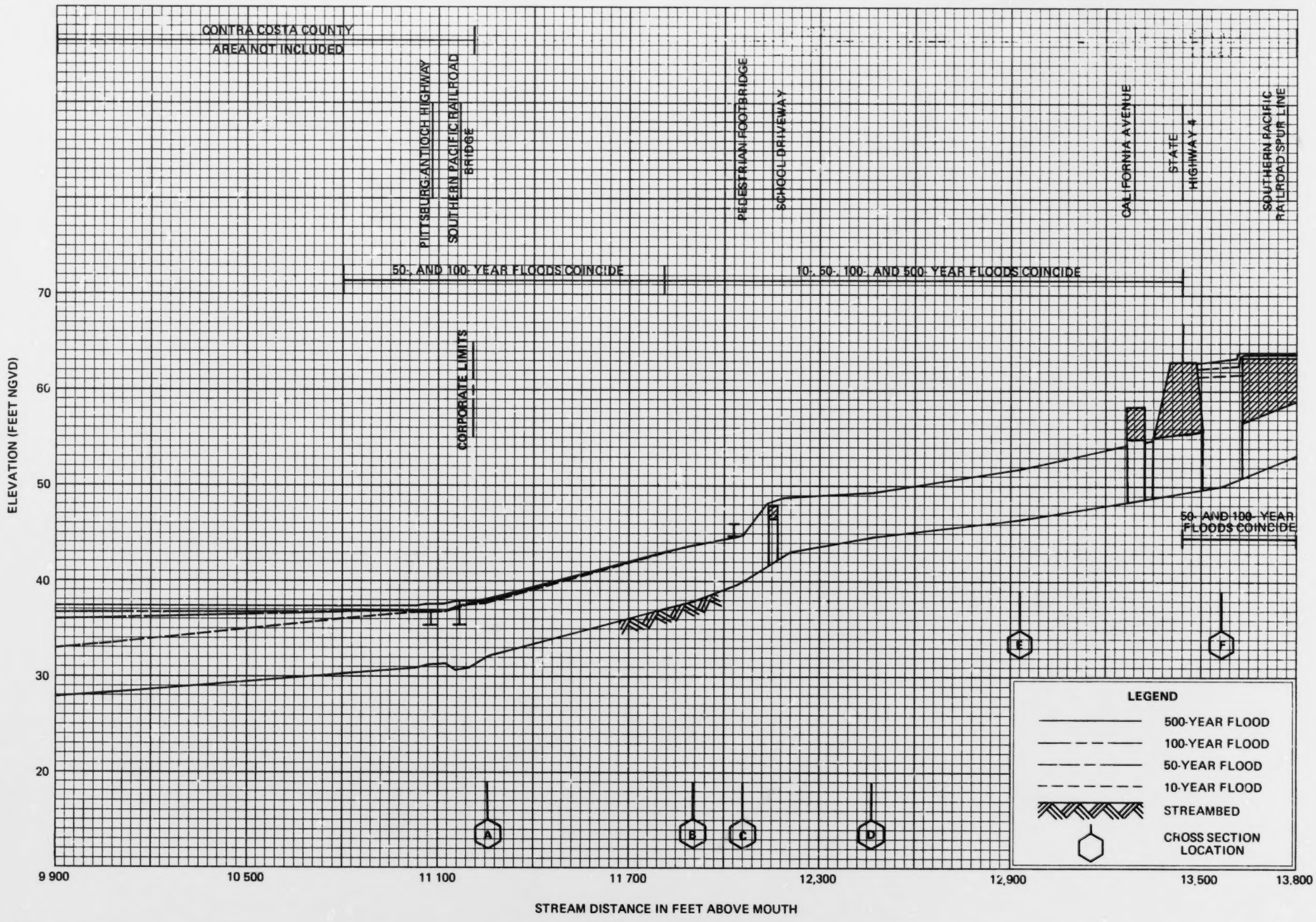

FLOOD PROFILES

KIRKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PITTSBURG, CA
(CONTRA COSTA CO.)

02P

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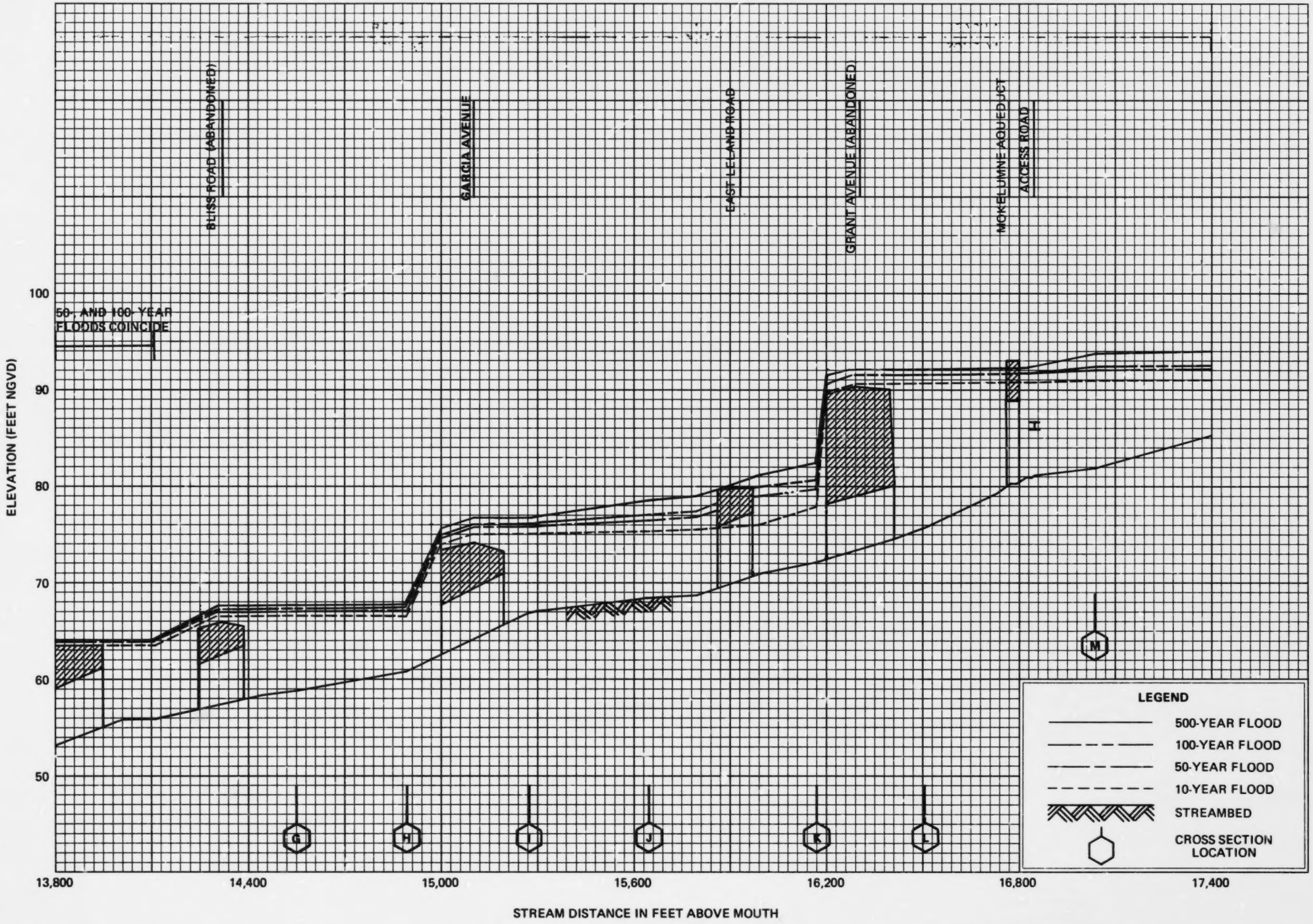

FLOOD PROFILES

KIRKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PITTSBURG, CA
(CONTRA COSTA CO.)

03P

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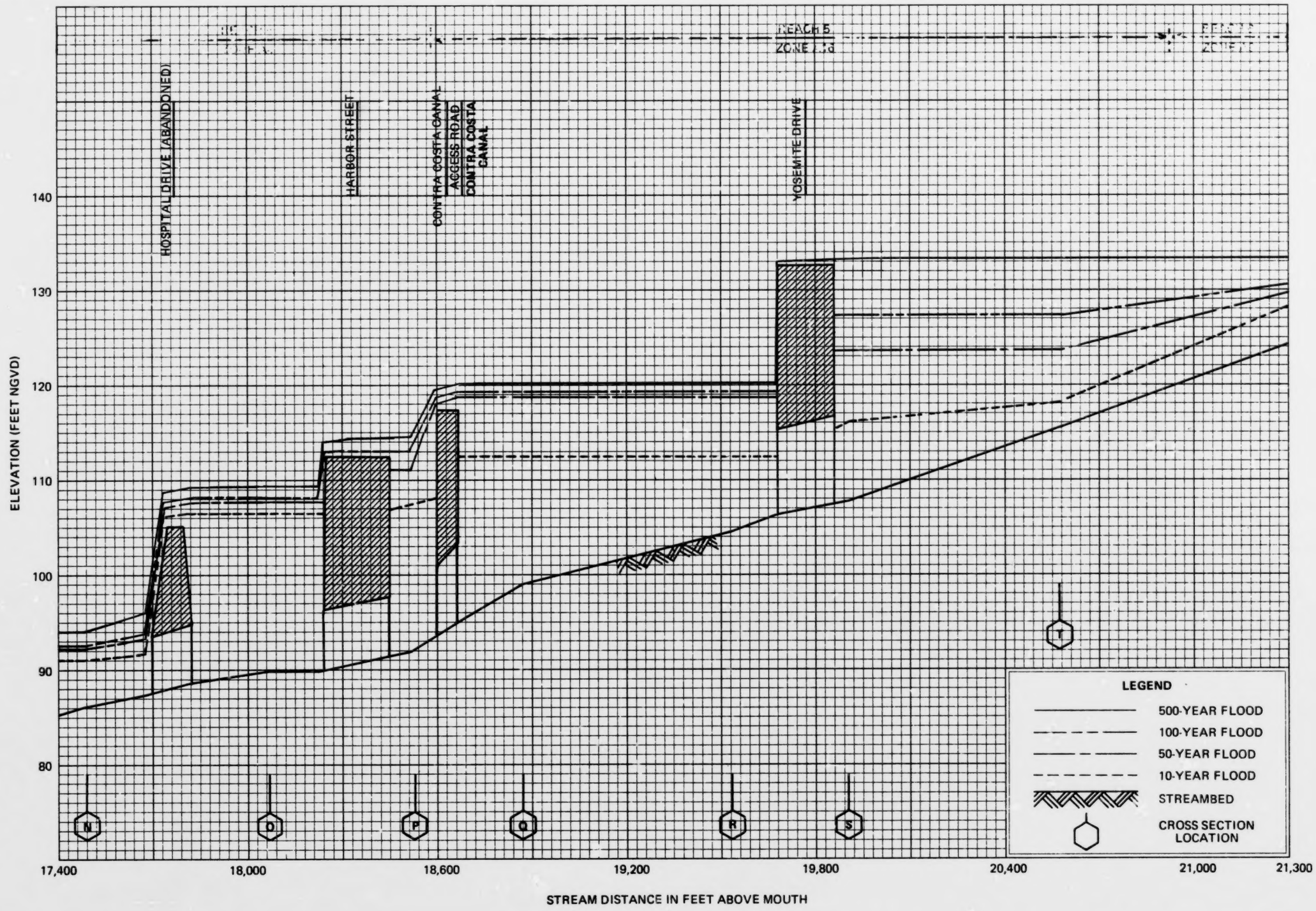

FLOOD PROFILES

KIRKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PITTSBURG, CA
(CONTRA COSTA CO.)

04P

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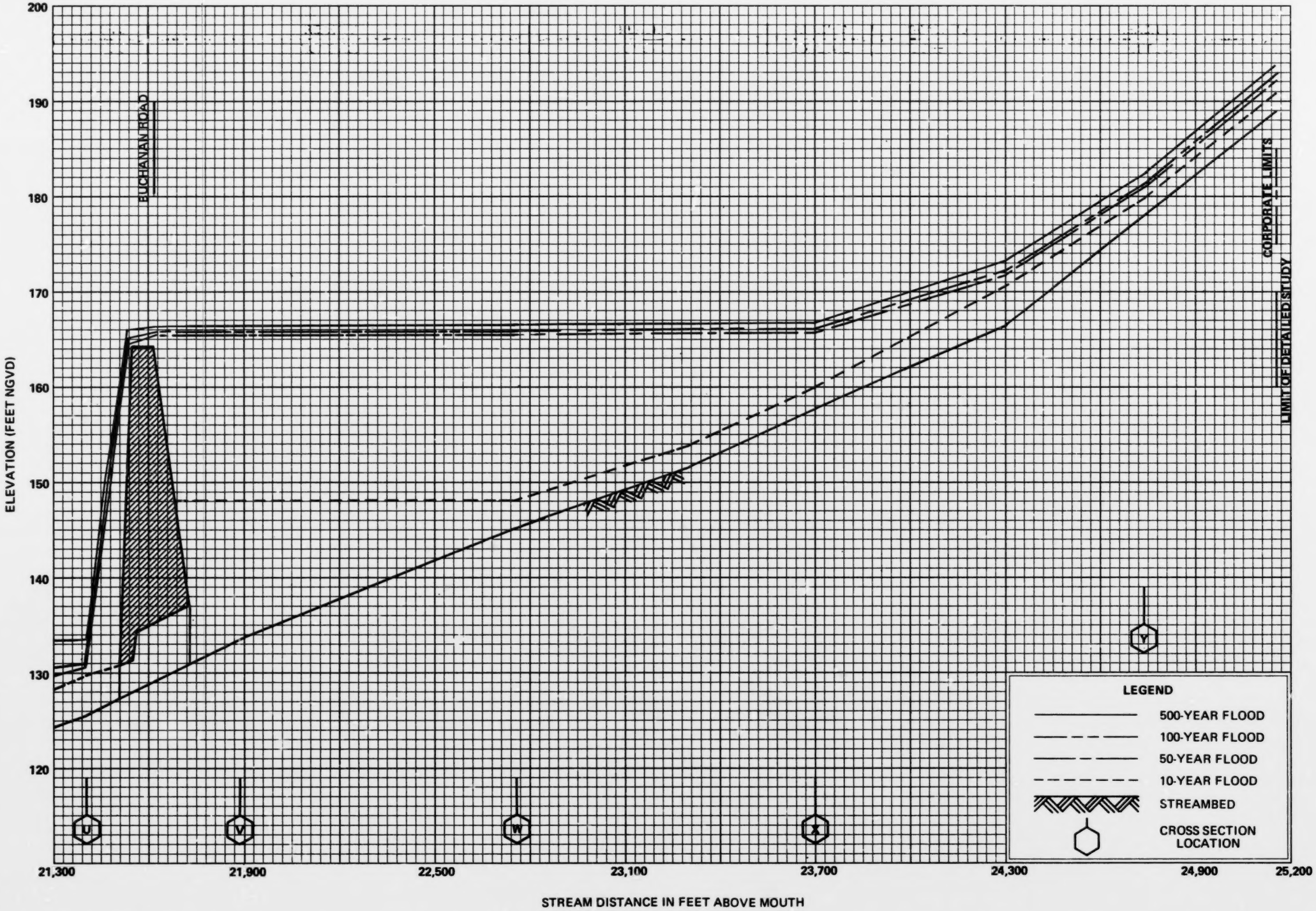

FLOOD PROFILES

KIRKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PITTSBURG, CA
(CONTRA COSTA CO.)

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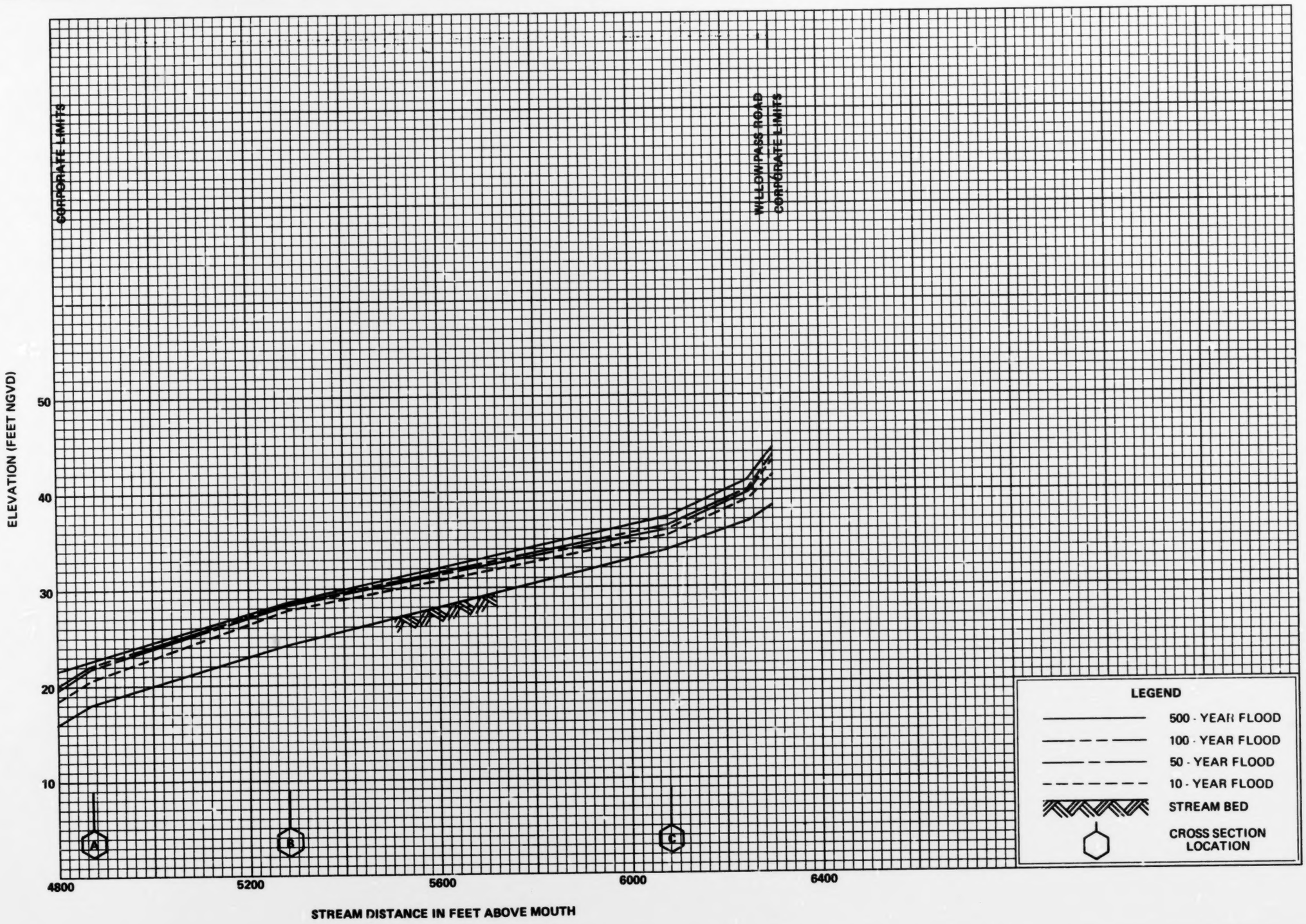

FLOOD PROFILES

LAWLOR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PITTSBURG, CA
(CONTRA COSTA CO.)

06P

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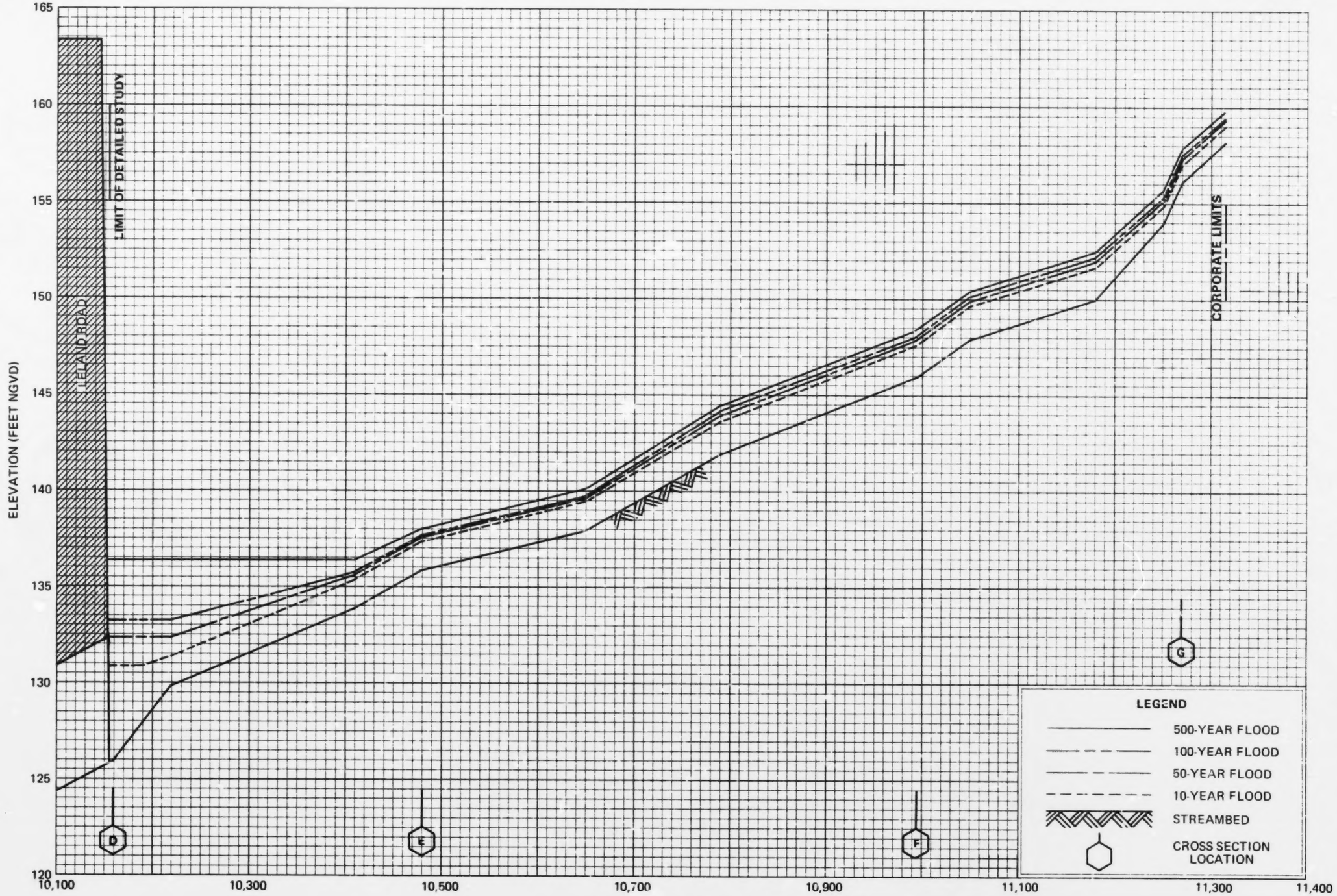

FLOOD PROFILES

LAWLOR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PITTSBURG, CA
(CONTRA COSTA CO.)

07P

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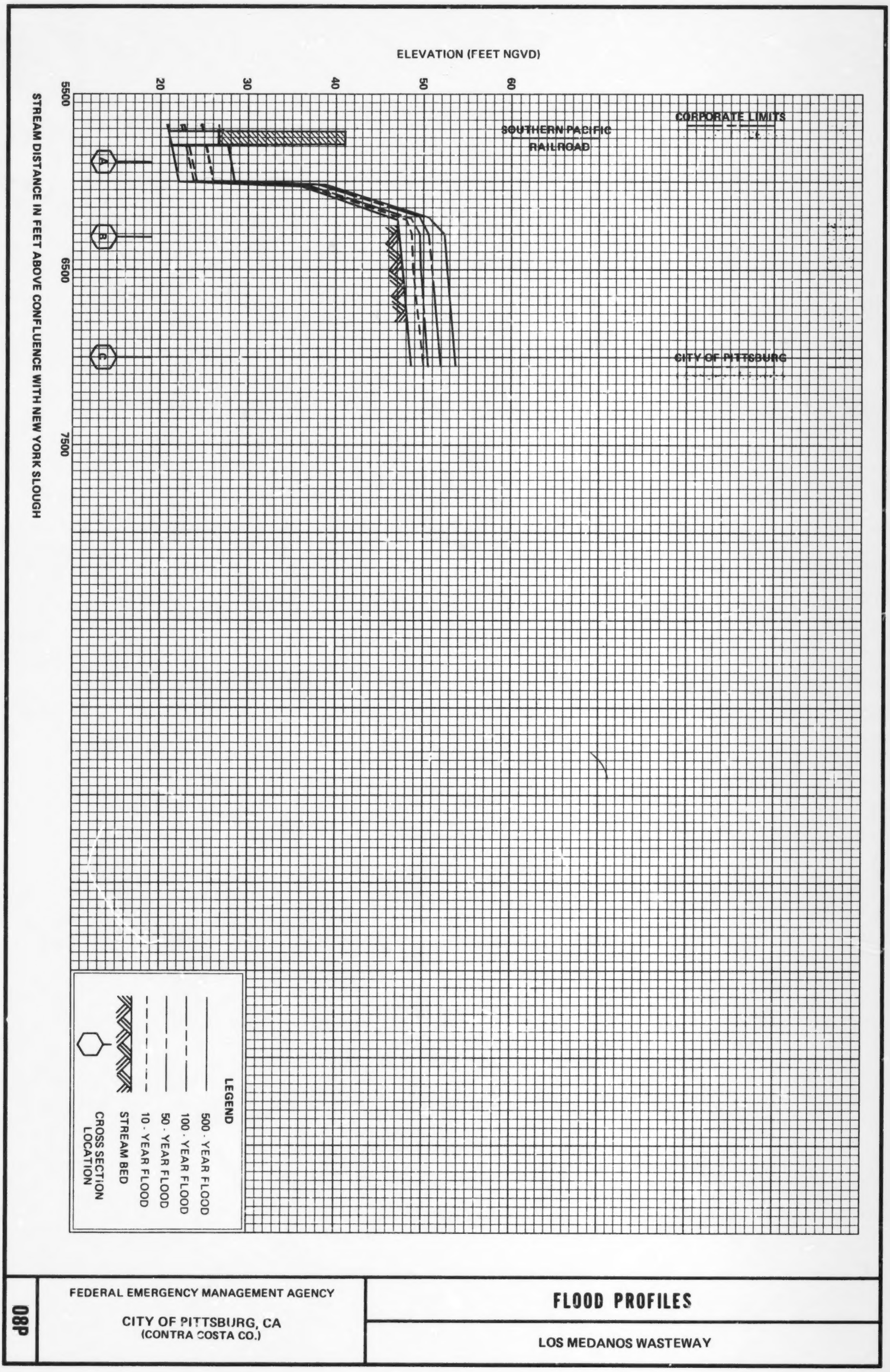

08P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF PITTSBURG, CA (CONTRA COSTA CO.)	FLOOD PROFILES LOS MEDANOS WASTEWAY

28

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